

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date
18 September 2003 (18.09.2003)

PCT

(10) International Publication Number
WO 2003/077340 A3

(51) International Patent Classification⁷: **H01M 8/10**, (8/02, 2/16) (74) Agent: **RUFF, WILHELM, BEIER, DAUSTER & PARTNER**; Kronenstr. 30, 70174 Stuttgart (DE).

(21) International Application Number: **PCT/EP2003/002550**

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(22) International Filing Date: 12 March 2003 (12.03.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PG 2002 A 000013 13 March 2002 (13.03.2002) IT

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant (*for all designated States except US*): **FUMATECH GMBH** [DE/DE]; Am Grubenstollen 11, 66386 St. Ingbert/Saar (DE).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **BAUER, Bernd** [DE/DE]; Hildenstrasse 10, 71665 Vaihingen an der Enz (DE). **ROZIERE, Jacques** [FR/FR]; 58 Avenue d'Occitanie, F-34090 Montpellier (FR). **JONES, Deborah** [FR/FR]; 58 Avenue d'Occitanie, F-34090 Montpellier (FR). **ALBERTI, Giulio** [IT/IT]; Via Torelli 67, I-06123 Perugia (IT). **CASCIOLA, Mario** [IT/IT]; Via Cortonese 74/A, I-06123 Perugia (IT). **PICA, Monica** [IT/IT]; Fraz. Morano Madonnuccia 37/A, I-06123 Gualda Tadino (IT).

Published:
— with international search report

(88) Date of publication of the international search report:
25 March 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 2003/077340 A3

(54) Title: **ION CONDUCTING COMPOSITE MEMBRANE MATERIALS CONTAINING AN OPTIONALY MODIFIED ZIRCONIUM PHOSPHATE DISPERSED IN A POLYMERIC MATRIX, METHOD FOR PREPARATION OF THE MEMBRANE MATERIAL AND ITS USE**

(57) Abstract: The invention provides composite membrane materials comprising a polymer of the state of art uniformly filled with a zirconium phosphate, preferably α -zirconium phosphate or zirconium phosphate sulfoarylenphosphonate particles. The composite membrane materials are preferably prepared starting from a solution of a polymer of the state of art and from a colloidal dispersion of α -zirconium phosphate or a zirconium phosphate sulfoarylenphosphonate. The colloidal particles are transferred into the solution of the polymer preferably by mixing the dispersion with the solution or by means of phase transfer. The membrane material is preferably obtained by removing the solvent by evaporation or by a suitable non-solvent. Besides the composite membrane materials and the preparation methods, the use of the above membrane materials is claimed as ionomeric membranes with high overall performance in high temperature, especially hydrogen, and in indirect methanol fuel cells and with decreased methanol crossover in direct methanol fuel cells.

Best Available Copy

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 03/02550

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	SCHUTZ P ET AL: "MATERIALS FOR MEDIUM TEMPERATURE SOLID STATE FUEL CELLS" EXTENDED ABSTRACTS, ELECTROCHEMICAL SOCIETY. PRINCETON, NEW JERSEY, US, vol. 87-2, 18 October 1987 (1987-10-18), pages 248-249, XP000115049 ISSN: 0160-4619 the whole document ---	1-23
X ..	ALBERTI G ET AL: "Solid-state protonic conductors, present main applications and future prospects" SOLID STATE IONICS, NORTH HOLLAND PUB. COMPANY. AMSTERDAM, NL, vol. 145, no. 1-4, 1 December 2001 (2001-12-01), pages 3-16, XP004310745 ISSN: 0167-2738 * see p.4., table 1 * the whole document ---	1-23
Y	ALBERTI G ET AL: "ALL SOLID STATE HYDROGEN SENSORS BASED ON PELLICULAR A-ZIRCONIUM PHOSPHATE AS A PROTONIC CONDUCTOR" SOLID STATE IONICS, NORTH HOLLAND PUB. COMPANY. AMSTERDAM, NL, vol. 35, no. 1 / 2, 1 July 1989 (1989-07-01), pages 153-156, XP000132461 ISSN: 0167-2738 * see p.156, par. 4, conclusions * the whole document ---	1-23
Y	BONNET B ET AL: "HYBRID ORGANIC-INORGANIC MEMBRANES FOR A MEDIUM TEMPERATURE FUEL CELL" JOURNAL OF NEW MATERIALS FOR ELECTROCHEMICAL SYSTEMS, SN, MONTREAL, CA, vol. 3, no. 2, 2000, pages 87-92, XP000997606 ISSN: 1480-2422 * see p.87, left. col, * the whole document ---	1-23
Y	NORBY T: "Solid-state protonic conductors: principles, properties, progress and prospects" SOLID STATE IONICS, NORTH HOLLAND PUB. COMPANY. AMSTERDAM, NL, vol. 125, 1999, pages 1-11, XP002252873 ISSN: 0167-2738 the whole document ---	1-23
		-/-

Best Available Copy

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 03/02550

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9629752	A 26-09-1996	DE	69608793 D1	13-07-2000
		DE	69608793 T2	01-02-2001
		EP	0815606 A1	07-01-1998
		JP	2000516014 T	28-11-2000
		WO	9629752 A1	26-09-1996
		US	5919583 A	06-07-1999
EP 0926754	A 30-06-1999	IT	MI972733 A1	10-06-1999
		DE	69813752 D1	28-05-2003
		DK	926754 T3	18-08-2003
		EP	0926754 A1	30-06-1999
		JP	11250922 A	17-09-1999
		US	6156184 A	05-12-2000
WO 0154216	A 26-07-2001	US	6447943 B1	10-09-2002
		US	6492047 B1	10-12-2002
		AU	2702101 A	31-07-2001
		AU	2702201 A	31-07-2001
		CA	2397536 A1	26-07-2001
		CA	2397568 A1	26-07-2001
		CN	1401143 T	05-03-2003
		CN	1411618 T	16-04-2003
		EP	1249052 A2	16-10-2002
		EP	1249053 A2	16-10-2002
		WO	0154220 A2	26-07-2001
		WO	0154216 A2	26-07-2001
		JP	2003520412 T	02-07-2003
		JP	2003520413 T	02-07-2003
		US	2003091883 A1	15-05-2003